



APPENDIX B: CARBON DIOXIDE CAPTURE TECHNOLOGY SHEETS

R&D COLLABORATIONS



PARTNERSHIP FOR CO₂ CAPTURE

primary project goals

The University of North Dakota Energy and Environmental Research Center (UNDEERC) is conducting pilot-scale testing to demonstrate and evaluate a range of carbon dioxide (CO₂) capture technologies to develop key technical and economic information that can be used to examine the feasibility of capture technologies as a function of fuel type and system configuration.

technical goals

- Integrate a high-efficiency flexible capture system with existing pilot-scale combustion and emission control systems to evaluate the performance of several capture techniques and technologies in flue gas streams derived from selected fossil fuels, biomass, and blends.
- Conduct testing of oxy-combustion for selected fuels and blends in one or more of UNDEERC's existing pilot-scale units.
- Evaluate the performance of emerging CO₂ capture technologies under development.
- Perform systems engineering modeling to examine efficient and cost-effective integration of CO₂ capture technologies in existing and new systems.

technical content

UNDEERC is constructing two pilot-scale systems with the intention of performing experiments on several advanced CO₂ capture technologies and comparing them to one another, as well as to monoethanolamine (MEA), which is considered to be the current state-of-the-art technology.

Baseline testing will be conducted using MEA to gather information to characterize each of the units. The results obtained by using MEA in the CO₂ absorption system will be used as a standard by which all other solvents will be compared. Data to be collected includes CO₂ removal, CO₂ purity, required regeneration heat, and effects of sulfur oxide (SO_x), nitrogen oxide (NO_x), particulate matter, and trace metals.

Baseline testing of the oxy-combustion system will follow similar procedures as the absorption system. The data collected will be used to identify potential challenges concerning this technology. These challenges include effects of mercury (Hg) capture, flame stability, fouling, slagging, and heat-transfer issues.



Figure 1: UNDEERC Post-Combustion CO₂ Capture Test Facility

technology maturity:

Pilot-Scale

project focus:

Partnership for CO₂ Capture

participant:

University of North Dakota
Energy & Environmental
Research Center (UNDEERC)

project number:

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N/A

performance period:

6/30/08 – 4/30/13

Once CO₂ capture technologies have been selected, testing will begin. Some of the technologies under consideration include other solvents (monodiethanolamine [MDEA], tailored amines, designer amines, ammonia, and potassium bicarbonate), membranes (metal membranes and carbozyme), and solid sorbents (zeolites, metal-organic frameworks, solid amines, and C-Quest). In addition to testing these technologies, different fuels will be used to evaluate their impact on the performance of the fabricated test units. Factors to be examined will include the effects of SO_x, NO_x, and other gas components; effects of ash deposition along with corrosion of refractory; and alloy components.

UNDEERC has completed the construction of the oxy-combustion system and has begun shakedown testing of the units. UNDEERC has also completed an Aspen model of the solvent absorption and stripping column (SASC) system.

technology advantages

UNDEERC will be capable of providing experimental data for a variety of advanced CO₂ capture technologies and oxy-combustion systems. This information will not only provide needed information for further advancement, but will provide a clear comparison of various approaches.

R&D challenges

Retrieving enough information on existing technologies to make appropriate selections for testing.

results to date/accomplishments

- Test campaign with Huntsman advanced solvent completed.
- Test campaign completed for evaluation of Cansolv's next generation solvent.
- Evaluation of C-Quest technology completed.
- Completed design and construction of the post-combustion test system.
- Completed the oxy-combustion retrofit.

next steps

Submit final report.

available reports/technical papers/presentations

Chen, S.G.; Lu, Y.; and Rostam-Abadi, M., "Carbon Dioxide Capture and Transportation Options in the Illinois Basin," Topical Report Oct 1, 2003–Sept 30, 2004 for U.S. Department of Energy Contract No. DE-FC26-03NT41994.

Metz, B.; Davidson, O.; Coninik, H.; Loos, M.; and Meyer, L. "IPCC Special Report Carbon Dioxide Capture and Storage Technical Summary," ISBN 92-9169-119-4, September 2005.

Narula, R.; Wen, H.; and Himes, K., "Economics of Greenhouse Gas Reduction – The Power Generating Technology Options," presented at the World Energy Congress, Buenos Aires, Brazil, October 2001.